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RESEARCH ARTICLE

EVALUATE THE EFFECT OF DIFFERENT LEVEL OF NITROGEN ON GROWTH AND YIELD PARAMETERS OF SPINACH

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ABSTRACT

The present investigation was carried out in Randomized Block Design (RBD) with three replications during 2022-2023 at vegetable farm of Guru Kashi University, Talwandi Sabo. The different nitrogen level (control, N_2: 65Kg/acre, N_2:75 kg/acre, N_3: 85kg/acre) as basal dose was used for studying the growth and yield parameters of spinach. The result revealed that N_3 (75 Kg/acre) is showing maximum plant height (32.38 cm) followed by N_2 (65kg/acre). Whereas the N_1: control is showing minimum 20.12 cm plant height. Maximum stem girth is recorded in N_3 (1.85) followed by N_2 (1.78) and N_4 (1.73). Whereas the N_1: Control is showing minimum stem girth. The number of leaves are maximum in N_3 (12.33) followed by N_2 (11.33) and N_4 (10.33). Whereas the N_1: control is showing 8.33 numbers of leaves. The leaf area is maximum in N_3 (546.63) followed by N_2 (527.40) and N_4 (422.10). The fresh plant weight (g) is maximum in N_3 (15.98) followed by N_2 (14.62) and N_4 (13.39). The maximum yield per plot is recorded in N_3 (1.61 kg) followed by N_2 (1.47) and N_4 (1.38). Whereas the N_1: control is showing minimum (0.82kg) yield per plot. Therefore the use of nitrogen-75kg/acre can able to increase the plant height, number of leaves, stem girth, leaf area, plant weight (fresh and dry) and yield.

INTRODUCTION

Spinacia oleracea is cool-season annual green leafy vegetables in the member of family Amaranthaceae (Vazquez *et al*., 2013). It is commonly known as Spinach (English), Palak (Hindi; Gujarati; and Marathi; Kashmiri), Pasalai (Tamil), and Mathrubhumi (Telugu) (Kirtikar and Basu 2005). It is native to South-West Asia and widely distributed and cultivated through the world including Iran as vegetables (Roughani and Miri 2019). In India Andhra Pradesh, Maharashtra, Kerala, Gujarat, Tamil Nadu, Telangana, Uttar Pradesh, Karnataka, and West Bengal are leading producing states of spinach. It is having good nutrition and biological values. It is used as raw, canned, boiled, pureed, frozen, dehydrated, and baked (Slavin and Lloyd 2012). It possesses 91.4 percent water, protein (2.9 percent), carbohydrates (3.6 percent) and fats (0.4 percent) (Lasya 2022). It is a rich source of fiber and has an added benefit of a low calorie content (Waseem *et al*. 2021). It is a rich source of major micronutrients such as iron, manganese, zinc, and magnesium (Patricia 2014; El-Sayed *et al*. 2020). It also contains small quantities of vitamin E, A, C, K, folate, thiamine (B1), pyridoxine (B6) and riboflavin (B2) (Grinenko and Zhuravel 2017). It is having phytonutrients and bioactive compounds like β-carotene, lutein, zeaxanthin, ascorbic acid, flavonoids, and polyphenols (Manzoor *et al*. 2020; Salehi *et al*. 2019).

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It prevent obesity, diabetes (Li *et al*. 2016), sore eye (Ozawa *et al*. 2016), cold, sneezing, fever, brain and heart diseases (Roberts *et al*. 2016; Roughani and Miri 2019). It is also having anti-bacterial properties (Olasupo *et al*. 2018). In growth and development of spinach nitrogen, phosphorous and potash fertilizers are playing essential roles. Nitrogen as key component of amino acids is an essential macronutrient for plant function, which form the building blocks of plant proteins and enzymes. These proteins further make up the structural materials of all living matters and enzymes facilitate the many biochemical reactions within a plant (Yousaf *et al*. 2021). It is also known that spinach is not very efficient in both uptake and utilization of nitrogen. So, timely application of nitrogen fertilizers plays dominant role on yield and quality of spinach plants (Rop *et al*. 2012). The nitrogen also plays major role in phytochemical accumulation and antioxidant activity in spinach (Machado *et al*. 2020). It is well known as the use of nitrogen in optimum ratio plays critical role. High application rates of nitrogen not only caused reduced crop yields but also adversely affected quality of crop (Chen *et al*. 2004). It also causes environmental problems like ground water pollution and Soil erosion (Ji *et al*. 2006). As a result, an efficient use of Nitrogen is a critical area in horticultural crop production management. Therefore present study was conducted during 2022-2023 at Guru Kashi University, Talwandi Sabo, Punjab, India with following objectives to evaluate the effect of Nitrogen (N) fertilizers on growth and yield parameters of spinach.

MATERIALS AND METHODS

The present study was conducted at Guru Kashi University, Talwandi Sabo, Punjab, India during 2022-2023.

Experimental layout and details for the experiments: One Fifty gram seeds per plot at the depth of 3-4 cmwere sown Five plants were selected at random in each plot to record the observations mentioned below. Random block deign (RBD) was used for present experiment. Total three replicas for each treatment were used. Following treatments of nitrogen in the form of urea was used as basal dose for theexperiments (Table 1).

Table 1. Treatments of Nitrogen used for experiment

Treatments Number	Treatments details
N_1	Control (without application)
N_2	65 kg/ acre
N_3	75 kg/acre
N_4	85 kg/ acre

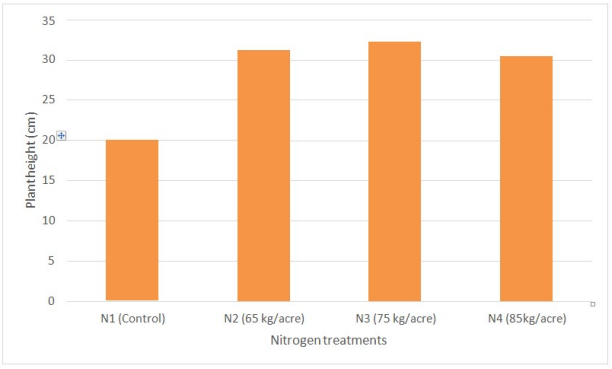


Fig 1. Plant height (cm) of spinach as affected by different level of nitrogen fertilizer

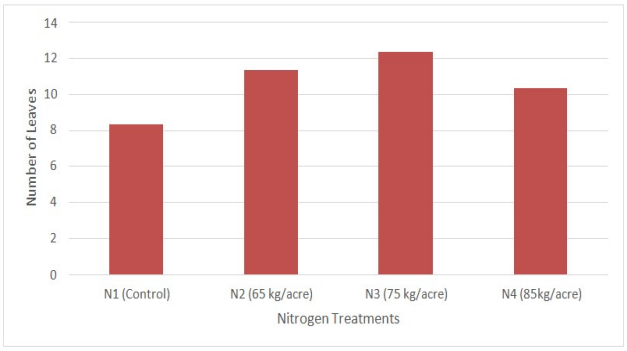


Fig 2. Number of leaves of spinach as affected by different level of nitrogen fertilizer

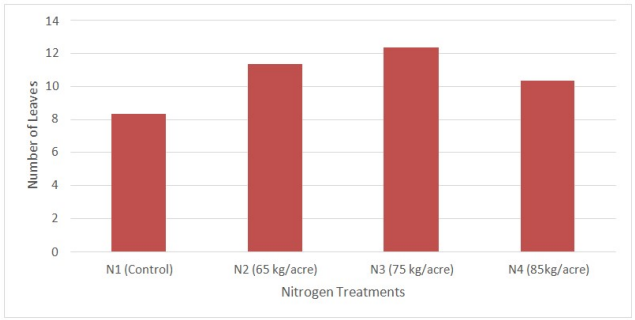


Fig 3. Stem girth (cm) of spinach using different level of nitrogen fertilizer

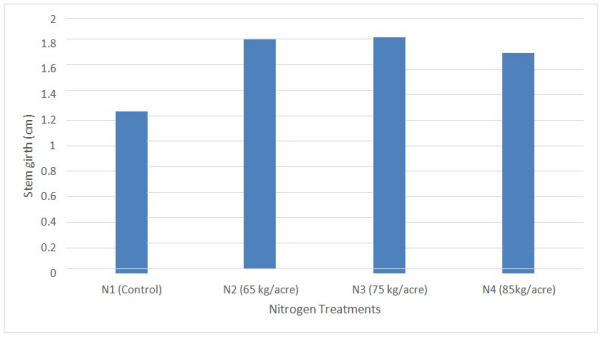


Fig 4. Leaf Area of spinach using different level of nitrogen fertilizer

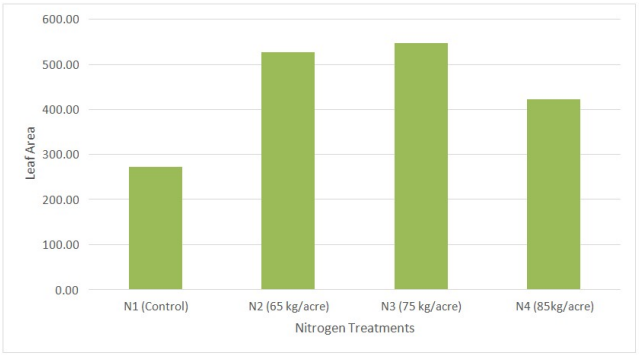


Fig 5. Fresh and Dry plant weight (g) of spinach using different level of nitrogen fertilizer

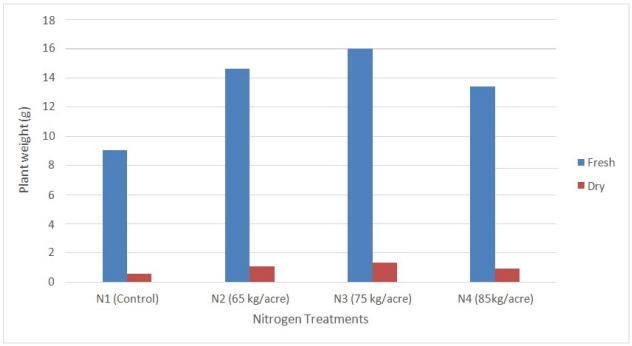
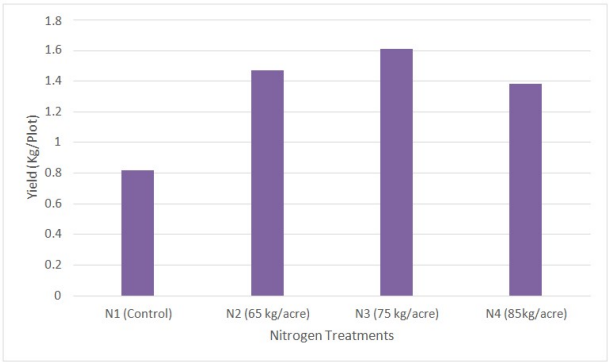


Fig 6. Yield (Kg/Plot) of spinach using different level of nitrogen fertilizer



The following observation was recorded: Plant height, Number of leaves, Stem girth, Leaf area, Plant fresh weight, Plant dry weight and yield. The collected raw data during experiment trial was transfer on the Excel sheet in Microsoft Excel 2016. Further ANOVA analysis was done using OPSTAT.

Table 2. Effect of different level nitrogen on growth and yield of spinach

Characters / Treatments	Plantheight (cm)	No. ofleaves	Stem girth (cm)	Leaf area (cm2/plant)	Plant weight (g)		Yield (Kg/plot)
					Fresh	Dry	
N_1 (Control)	20.12	8.33	1.27	271.33	9.07	0.59	0.82
N_2 (65 kg/acre)	31.25	11.33	1.78	527.40	14.62	1.05	1.47
N_3 (75 kg/acre)	32.28	12.33	1.85	546.63	15.98	1.35	1.61
N_4 (85kg/acre)	30.50	10.33	1.73	422.10	13.39	0.91	1.38
SE (m)	0.29	0.50	0.02	13.62	0.40	0.40	0.03
CD	0.91	1.56	0.07	42.40	1.26	1.26	0.08

RESULTS AND DISCUSSION

The results of present study revealed that the N_3 was showing maximum plant height (32.38 cm) followed by N_2 (31.25 cm) and N_4 (31.25 cm). Minimum 20.12 cm plant height was recorded in N_1: Control (Fig 1). Maximum stem girth was recorded in N3 (1.85 cm) followed by N_2 (1.78 cm) and N4 (1.73 cm). Whereas the N_1: Control was showing (1.27cm) minimum stem girth (Fig 3). The number of leaves were maximum in N_3 (12.33) followed by N_2 (11.33) and N4 (10.33). Whereas the N_1: Control was showing minimum (8.33) number of leaves (Fig 2). The leaf area was maximum in N3 (546.63) followed by N_2 (527.40) and N_4 (422.10). Whereas the N_1: Control was showing minimum (271.33) leaf area (Fig 4). The fresh plant weight (g) was maximum in N3 (15.98g) followed by N_2 (14.62g) and N_4 (13.39g). Whereas the N_1: Control was showing minimum (9.07 g) fresh plant weight (Fig 5). The dry plant weight (g) was maximum in N3 (1.35g) followed by N_2 (1.05g) and N_4 (0.91g). Whereas the N_1: Control was showing minimum (0.59 g) dry plant weight (Fig 5 and Table 2). Finally maximum yield per plot was recorded in N_3 (1.61 kg) followed by N_2 (1.47) and N_4 (1.38kg). Whereas the N_1: Control was showing minimum (0.82 kg) yield (Fig 6 and Table 2). Therefore Overall the N_3 (75kg/acre) is showing maximum plant height, number of leaves, stem girth, leaf area, plant weight (fresh and dry) and yield. But as the nitrogen level increases the all the growth and yield parameter decrease. Similar study was recorded in spinach by Darshan *et al*. 2019 where the nitrogen level increase leads to decrease in plant height, stem girth, and yield. Chen *et al*. (2004) also reported high application rates of nitrogen not only caused reduced crop yields but also adversely affected crop quality.

CONCLUSION

The Nitrogen plays essential role in growth and development of spinach. It is key component of amino acids which form the building blocks of plant proteins and enzymes. Therefore the basal application of nitrogen in leafy vegetable is helps in growth and yield of perishable leafy vegetable like spinach.

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